

waste" in contradistinction to "commercial waste," should be allowed to go on. If his argument is a sound one, a tenant is justified in only getting such coal as is *most* cheaply obtained, and in leaving buried in the bowels of the earth, unattainable by future generations, valuable material merely because the getting of it would involve more cost than would attend the raising of coal from thicker and more cheaply workable seams. When a tenant rents *all* the coals under a given acreage of ground his interest in the property is temporary and limited. It is therefore to his interest to raise only such coal as can be most cheaply raised in the shortest space of time. It is not necessary that the raising of the coal which he thus abandons should involve an actual loss to the tenant. It is enough for the argument that he would have to raise it at a diminished profit, which he will certainly not do if he is permitted to devote the same time and labour to such coal as will leave him more profit. Of course freedom of trade and labour suggest that a man should be allowed to pursue the course most profitable to himself, but seeing the vital importance of our coal supply to our existence as a manufacturing nation, it does appear to me that the coal-raiser should be prevented by the lord of the manor primarily—or, if he fails to do his duty, by the legislature—from thus wasting the chief instrument in the production of our national wealth—even if such interference involved some reduction of his profits, or of some addition to the price of coal.

I need not say more to show the interesting character of the contents of this unpretending volume. It is most creditable to its authors, and I shall be much surprised if its merits do not meet with a wide recognition.

W. C. WILLIAMSON

ASCENSION

Six Months in Ascension; an Unscientific Account of a Scientific Expedition. By Mrs. Gill. (London: John Murray, 1878.)

THOSE who know anything of Ascension will wonder how on earth any one could find sufficient material during even a six months' stay to write a volume of 300 pages upon it. We doubt if any one but a lady circumstanced as Mrs. Gill was could have made a readable story out of the barren materials to be found on this land-ship of an island, as it really is, to all intents and purposes; and she has managed to write a thoroughly interesting narrative. If every scientific worker were as fortunate as Mr. Gill in having so sympathetic a companion and coadjutor to tell all the circumstances of his work, the world might think a great deal more of those apparently dry figures and easily-expressed results, which seem to have no touch of nature about them. To those who see only the scientific side of the matter, it may seem a very simple and very pleasant thing to watch the stars night after night; let such read Mrs. Gill's book, and perhaps they will have more sympathy and perhaps a little pity for astronomers sent on scientific expeditions to remote islands.

Mr. Gill, as many of our readers will remember, spent the last six months of 1877 on the Island of Ascension for the purpose of observing Mars in opposition, an opportunity occurring then such as would not occur again during the century. Lord Lindsay lent his celebrated

heliometer, the Astronomical Society granted 500*l.*, and the Admiralty did all in their power to make Mr. Gill's sojourn on Ascension as pleasant and successful as possible. In an introductory chapter Mr. Gill gives an exceedingly interesting sketch of the principal previous attempts which have been made to measure the distance of the sun, and the results that have been come to with regard to that hitherto rather inconstant "constant." The perusal of this chapter will not only be instructive to the general reader, but must greatly increase the interest of the subsequent narrative, showing as it does the important results that depended on the success of the expedition, the human side of which is so graphically described by Mrs. Gill. She herself gives a brief but very successful explanation, in popular language, of how the sun's distance is measured.

As outgoing vessels seldom touch at Ascension, the expedition, consisting of Mr. and Mrs. Gill, with their heavy baggage, were detained for some time at St. Helena, a detention which both seem to have enjoyed. Mr. Gill succeeded in finding what he, with considerable probability, surmises to have been the site of the observatory used by Halley, in 1677, to observe the transit of Mercury, and make his catalogue of southern stars. They of course saw all the lions of the island, and Mrs. Gill's descriptions are so clear and fresh that even those who have read much about St. Helena will find in them much to interest. Even when Ascension was reached, it was no easy matter to land through the great "rollers" which are so characteristic a feature of some Atlantic islands. We hear a good deal about these puzzling phenomena, which are so difficult to account for, but which Mrs. Gill is inclined to think are probably due to the cause suggested by Capt. Evans. That keen-sighted hydrographer thinks these rollers are probably the far-reaching result of the breaking-up of the continents of ice in the Antarctic regions, miles and miles of which break off, and, plunging into the sea, give rise to huge submarine waves, whose strength is not expended even when they reach Ascension and St. Helena. Mrs. Gill's description of life in Ascension, and especially of the life of the "expedition," is given with a good-natured and graphic pencil. At first the observatory was established on an admirable piece of ground at George Town (or "Garrison," as it is called on the island), on the West Coast, where a very nice cottage was allotted to the astronomer and his wife. Her house-keeping difficulties are amusing enough to read of, though at first awkward enough to one unaccustomed to garrison or rather naval life. Ascension is to all intents and purposes one of her Majesty's ships at anchor, and everything is conducted exactly as on shipboard. All food and drink are served out at fixed time as rations, and as supplies are at all times limited, there is ample room for economical management, and little room for luxury and extravagance. The new-comers soon became accustomed to the routine of the land-ship, and after a day or two got comfortably settled in their cottage, and had the heliometer and other instruments most satisfactorily located on their solid asphalte floor. But, unfortunately, this happy state of things was not without a cloud—a real genuine cloud—which threatened to frustrate the great object of the voyage and all the preparations. This

cloud persistently hung over the island and prevented anything like satisfactory observation, and had it not been for Mrs. Gill's pluck, failure might have been the result. It occurred both to her and her husband that the cloud was only local, and to prove the truth of this suggestion, Mrs. Gill undertook a journey along the coast, starting about midnight, over great cinders and deep rifts, to a point almost four miles south. The supposition proved true, and amid many difficulties the observatory was dismantled, and the instruments removed to the southwest of the island, to a small inlet christened Mars Bay, in memory of the expedition. But what a change from "Commodore's Cottage," as the "Garrison" residence was called. Ascension is an extinct volcano, and it is now little more than a huge mound of cinders and dust. On such floor did Mr. Gill pitch his tent, and on such a base had he to erect his delicate instruments. The discomforts attending his surroundings knocked him completely up, but with the help of Mrs. Gill and the doctor he was set on his feet again, and by the ministry and companionship of the former the encampment was made tolerable. Fortunately after all these hardships and trials and doubts as to weather, the observations at the critical time were completely successful, as were a long series of subsequent comparison observations. The captain of the island and his subordinate officers deserve the greatest credit for the assistance and support which they gave to the enthusiastic astronomer and his ever-helpful and cheerful wife. After the real work of the expedition was completed Mr. and Mrs. Gill made several excursions over the tiny island, and with the exception of an oasis on the summit of the "mountain," the island seems dreary in the extreme, and Mrs. Gill failed to find the neat square gardens and paved streets seen by Sir Wyville Thomson. Altogether, on a very unpromising subject, she has succeeded in writing a really interesting and instructive book, telling us much about the islet and its inhabitants, and still more about the circumstances under which an important piece of scientific work was done. We strongly recommend it to the perusal of our readers.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Schwendler's Testing Instructions for Telegraph Lines

IN the absence of my friend Mr. Schwendler in India, perhaps I may be allowed to offer a few remarks on the notice of his book on line-testing which appeared in NATURE, vol. xix. p. 192.

It must be remembered that the book is primarily intended for the use of the officers of the Indian Telegraph Department, and that the conditions in that country differ very much from those in England. Here the overland lines are in such positions that any accident happening to them may be easily detected, but in India the lines run in many parts through countries with few inhabitants, and the distances between stations is sometimes very great. Formerly when a breakdown or fault occurred, the line-riders were sent out from the stations to find out what was the matter, and Mr. Schwendler gave a very amusing account of two of these natives riding out from the two ends of the line to find

a fault, meeting in the middle, salaaming and asking one another if anything wrong had been seen. On receiving a negative reply they salaamed and rode back, but the line was none the better for it. It must be, to say the least, tedious to ride many miles over a rough country staring at a wire on an Indian sky on the chance of finding a dead snake across the wires or a bird's nest on an insulator. These difficulties suggested the very systematic line-testing now in vogue in India.

It is unfortunate that the reviewer has shown such a disrespect for mathematical formulæ. There is no doubt that the book swarms with them, but it is by means of these that Mr. Schwendler has discovered many of the facts stated in the book, some of which your contributor seems to doubt. I will, with your permission, instance two cases. He writes, "Indeed it is very doubtful whether his proof that the sensibility of the bridge method is greatest when the branch and the resistance are equal is true. At any rate in our practice we find that the more delicate the galvanometer of the bridge the more sensitive and the more accurate is our test."

In the last sentence it is not quite clear what the reviewer means by a "delicate" galvanometer. I do not know that Mr. Schwendler says that the galvanometer should not be delicate, but he does say that its resistance should bear a certain relation to the resistance measured. For a high resistance a galvanometer of high resistance should be used, and for a low resistance one of a proportionately low resistance. But the alteration of the resistance should not be made by using only a portion of the coils. This is fully explained on p. 22, where it is shown that the coils should be connected either consecutively or parallel in order to increase or diminish the resistance of the instrument. Thus all the convolutions of the galvanometer are used, but as the resistance is diminished in the second case a larger flow of electricity takes place and a greater deflection is produced. The results of these theoretical considerations are so readily tested by experiment that it is surprising that the author of the notice should have thrown doubt on their accuracy. I have therefore thought that it might be useful to make some measurements which have fully confirmed the theory. I will not trouble you with all the experimental numbers of about 160 measurements, which would be as "appalling" to the readers of NATURE as Mr. Schwendler's formulæ are to the writer of the review. A reflecting galvanometer with two coils was used. Connected consecutively their resistance was 5590 units and parallel 1405. The results would have been more striking if the coils had been of unequal resistance so that the parallel resistance would have been less, or if the two halves of the bobbins could have been connected parallel, which would have reduced the resistance to about 700 units. The following table will show the results obtained on measuring three resistances with varying branch resistances, and with the two arrangements of the galvanometer the deflections of which were noted when a certain alteration of the comparison coil was made:—

Resistance tested. Units.	No. of cells used.	Resistance of branches. Units.	Alteration of comparison coil. Units.	Deflection of spot of light with galvanometer coils	
				Consecutive.	Parallel.
4740	20	10	20	14	15
—	—	100	—	91	95
—	—	1000	—	192	190
760	20	10	4	23	39
—	—	100	—	140	234
—	—	1000	—	333	386
90	1	10	2	47	93
—	—	100	—	77	148
—	—	1000	—	77	121

¶ These numbers show that the branches should approximate to the resistance measured and also that the galvanometer resistance should be smaller when a small resistance is measured. Calculation shows that the most advantageous resistances of the galvanometer in the three cases would be 2870, 880, and 95 respectively.